1 Collecting Samples and Extracting Zircons

After a rock is collected in the field, zircon crystals need to be extracted through a series of steps including crushing, sizing, and segregation by density and magnetism

Collecting Rocks in the Field

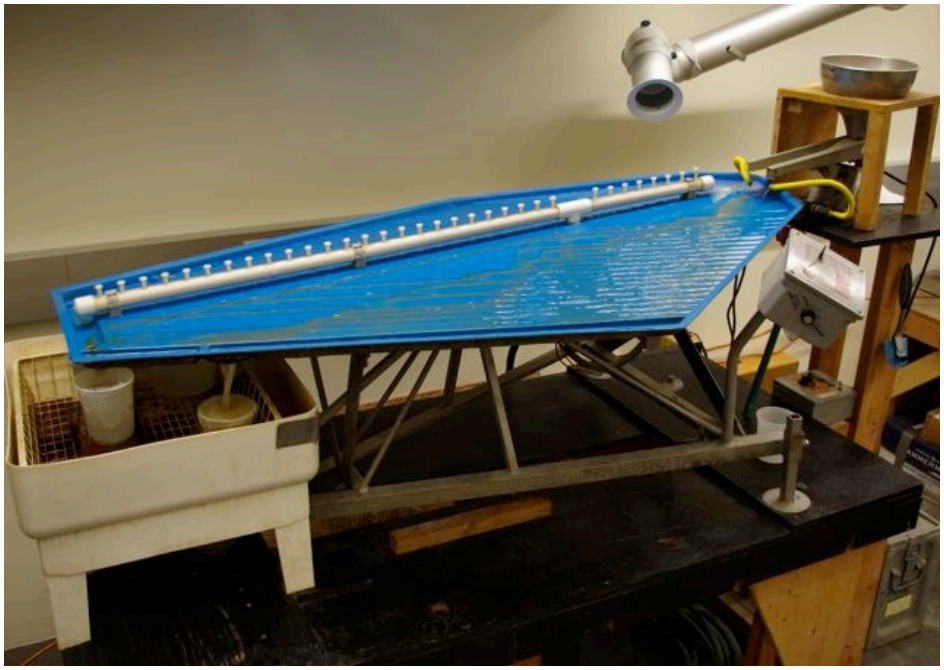
The first step in determining the numerical age of a rock is collecting a sample in the field. A geologist must be careful to collect rocks that are part of an outcrop (body of rock that is in place) rather than small pieces of rock on the ground that may have come from elsewhere. In this photo, the geologist is collecting a sample of volcanic ash layered in a sequence of sedimentary rocks.

Bringing the Rocks to the Lab

Rocks collected for geochronology are brought back to the lab for processing. Each rock sample has its own label and name recorded in a field notebook so that the geologist knows exactly where it came from.

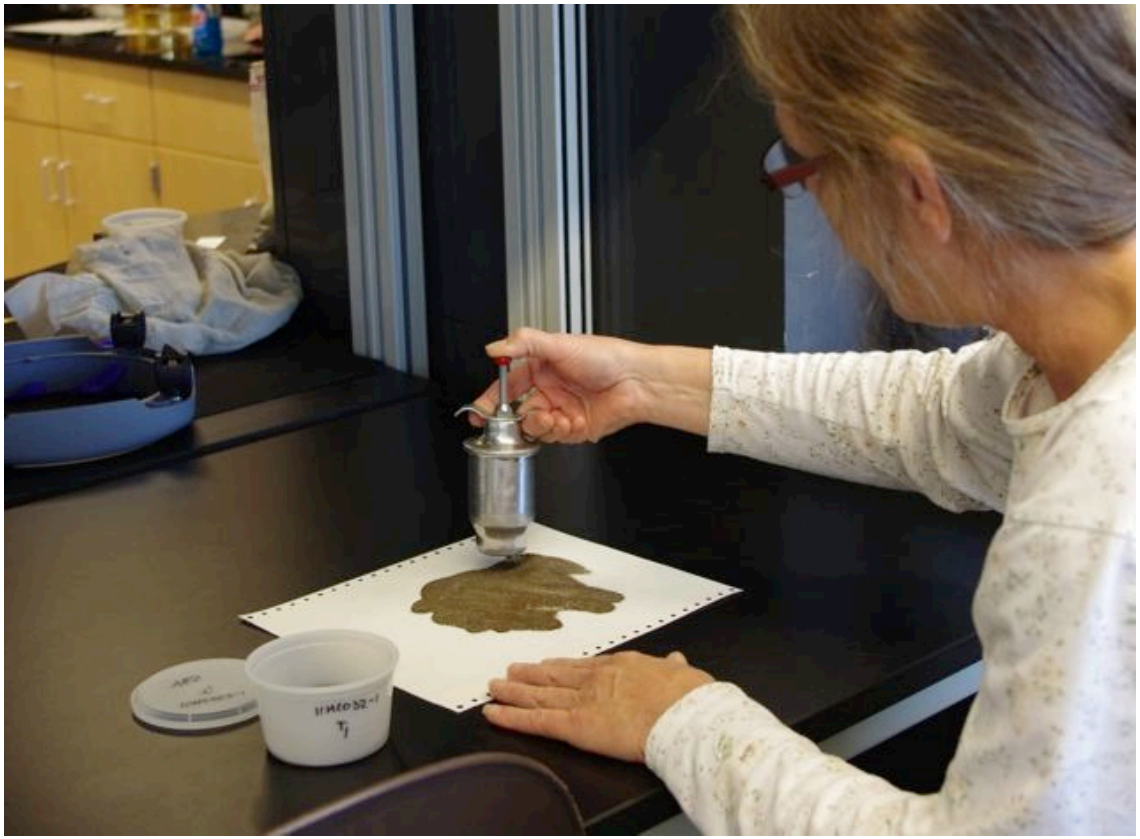
Grinding the Sample: the Jaw Crusher and Disk Mill

Each sample is broken into small pieces with a sledge hammer and then put through a Jaw Crusher (not shown) and Disk Mill (left photo) to separate the rock into tiny (less than 0.5 millimeter) mineral grains and grain fragments (right photo). This step allows the microscopic zircon crystals in the rock to be broken loose from the surrounding mineral grains.



Separating Mineral Grains by Density: the Water Table

The pulverized rock sample is washed over a shaking Water Table to separate the mineral grains by density. The sample is dropped onto the right side of the table and the mineral grains move down and to the left as the inclined table shakes from side to side and water streams across it. Light minerals get washed off the table into the front trough (white arrow), while heavy minerals like zircon get caught in the rills and grooves of the table and are collected at the far end (black arrow).



Separating Mineral Grains by Magnetism: the Hand Magnet

After being dried, the heavy (dense) sample fraction from the Water Table is passed over with a hand magnet. The magnet attracts the most magnetic minerals (not zircon) so that they can be removed from the sample.

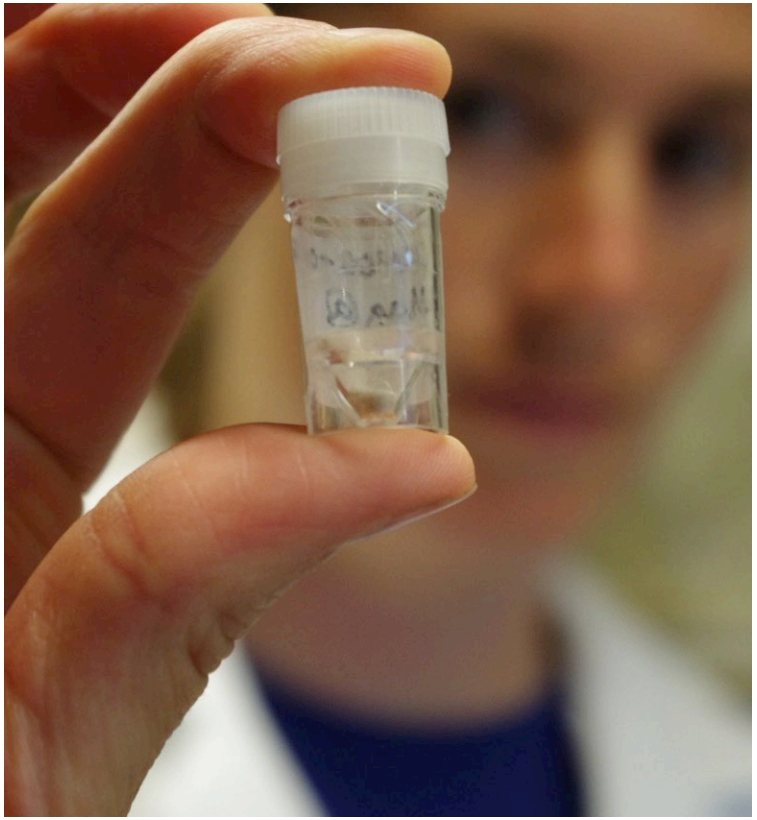
More Separation by Magnetism: the Frantz Magnetic Separator

While a hand magnet will remove very magnetic minerals, we can remove more weakly magnetic minerals by passing them through a strong magnetic field. The “Frantz” consists of a large magnet with two parallel trackways. The upper, inside track passes through the magnet, while the lower, outer track sits just outside of the magnet. As the sample goes down the inner track, magnetic minerals attracted to the magnet continue on their path to the black cup, while non-magnetic minerals like zircon fall into the lower outside track and end up in the silver cup. The non-magnetic fraction that contains the zircons will continue to be processed.



More Separation by Density: Heavy Liquids

The non-magnetic sample fraction from the Frantz contains both heavy minerals like zircon, and lighter minerals like quartz and feldspar. The heavy zircon crystals are further separated by using a dense liquid in a separatory funnel. Minerals like quartz and feldspar float at the top of the liquid, but dense minerals like zircon sink to the bottom. A valve at the bottom of the funnel is opened to allow the dense minerals to be collected and then cleaned with acetone.



A Final Magnetic Separation

After separation by density in the heavy liquid, the dense fraction is passed through the Frantz again to separate the least magnetic and highest quality zircon crystals. These zircons will be looked at under a microscope and selected for analysis.